Addis Ababa Science & Technology University

College of Architecture and Civil Engineering

Department of Construction Management

An Independent Project on - Cost and Time Overrun in Addis Ababa Housing Project

A Project Study Submitted to School of Civil Engineering Graduate Studies in Partial fulfillment of Masters' Degree of Engineering in 'Construction Technology and Management

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Thank you!

ABBREVIATIONS

Abbreviation		**Abbreviation**	
BCWS	Budgeted cost for the work scheduled	EVM	Earned value management
BAC	Budget at completion	EV	Earned value
AC	Actual cost	BCWP	Budgeted cost for the work performed
PV	Planned value	CPI^C	Cumulative cost performance index
CV	Cost variance	EV^C	Cumulative earned value
SV	Schedule variance	AC^C	Cumulative Actual cost
CPI	Cost performance index	SPI	Schedule performance index
LCH	low cost housing	ETC	Estimate to complete
CEH	cost efficient housing	MR	Management reserve
EVM	earned value management	ACWP	Actual cost for work performed
EV	earned value		

Abstract

Shelter, among the most essential human needs that plays a very important role in human life, has tremendous social and economic impact, influence on health, economy, environmental, political and social life of any society. Therefore, the objective of this proposed research is to Determine the main causes of cost and time overrun in Housing project and the technique and tools, contractors needs to forecast the cost and time performance in the development of housing program in Addis Ababa. The document search is also intended to collect values of cost and time overrun and their causes from Housing projects which are completed/substantially completed. Besides this, a questionnaire/survey has been conducted to strengthen the study and observe the understanding of the problem by all stakeholders/to see the prevalence of the problem in the industry. The questionnaires were distributed to contractors, consultants, the employer AAHPO and construction professionals. Questionnaires have been implemented as a research instrument to collect data. The information obtained from the respondents has been analyzed and summarized for discussion. Finally, I have set forth my conclusions based on the discussion results and recommendations are forwarded for better accomplishment.

TABLE OF ILLUSTRATIONS

CHAPTER - 1

1. Introduction

1.1 Background

Shelter, among the most essential human needs that plays a very important role in human life, has tremendous social and economic impact, influence on health, economy, environmental, political and social life of any society.

The housing problem in Addis Ababa is acute in both qualitative and quantitative terms. The total housing stock is 450,000. Out of this, 180,000 houses are used for trade and business while the remaining 270,000 are used for residential purposes.

Following the reform of the Addis Ababa city administration in 2003, the housing problem in the city has been given a special attention by launching large scale housing development program with the objectives of reducing housing deficiencies substantially within five years mainly targeting low-income groups. The city administration plans to build 250,000 houses in five years by constructing 50,000 units each year. Around 1.5 billion birr has been allocated for the 45,000 houses. (Construction Journal Magazine, 2007)

Several small and large construction firms are involved in the execution of such housing project with transactions of huge amount of money. These big funds need appropriate levels of skill, conscious and intelligent use to be controlled in order to apply them for the intended purpose. So cost and time management, as one of critical factor, a very important aspect for the contractor towards the successful completion of the project. These issues have led the authors to thoroughly study existing cost and time management methods followed by selected contractors specially cost and time controlling during the construction phase.

1.2 Research Question

The research methodology is designed in such a way that, it enables to collect adequate information to answer the following core research questions:

- What are the main causes of cost and time variances in Housing project and/or causes for cost and time overrun and what measure they use if it once occurred, and also associated cost and time risks?
- What techniques and tools are used for cost and time controlling purpose?

- What measures should be taken to avoid cost and time variance?

The document search was also intended to collect values of cost and time overrun and their causes from Housing projects which are completed/substantially completed. Besides this, a questionnaire/survey has been conducted to strengthen the study and observe the understanding of the problem by all stakeholders/to see the prevalence of the problem in the industry. The questionnaires were distributed to contractors, consultants, the employer AAHPO and construction professionals.

Questionnaires have been implemented as a research instrument to collect data. The information obtained from the respondents has been analyzed and summarized for discussion. Finally, I have set forth my conclusions based on the discussion results and recommendations are forwarded for better accomplishment.

1.3 General Objectives

Based on the Housing projects realized and those being implemented in Addis Ababa, the study focuses on cost and time controlling in the construction phase by the contractor in order to:

- Asses the concept of Effective utilization of cost and time in housing technology
- Determine the causes of variance and investigate the local practice within the frame work of cost and time control
- Provide recommendations

And also the Specific Objective are:

- To Identify the Significant Failure Factors That Prohibits Successful completion and cost and time overrun in housing Project in Addis Ababa.
- To Recommend Intervention Measures To Minimize The Critical Failure factors.

1.4 Scope

The research covers only the housing project implemented in Addis Ababa and it focuses on the cost and time controlling system used by contractors. The research is limited to Addis Ababa because of time and Resource limitations and relevant data are acquired from verbal and written reports. Meanwhile, it is based on questionnaires due to time shortage of to

possess documented information on the subject matter. Therefore, the investigation has mainly relied on these replies to the questionnaires by the respondents.

1.5 Structure of the research

Basically, the thesis is grouped under five chapters, the first being the introduction to the structure and contents of the study.

In chapter two, contextual framework of the study is covered. It addresses the housing problem of Addis Ababa, housing technology and its objectives.

In chapter three: the conceptual/ literature review is attempted as applied to cost and time controlling management. The cost and time control component includes the main causes of cost and time variance and the associated cost and time risks, techniques, tools and others issues.

In chapter four: the methodology used in this research is presented in a detailed manner.

In chapter five: I have discussed the analysis of the results obtained from conducting the research and Chapter 6 deals with the explanation, conclusion and recommendations of the findings.

At the end, the questions for questionnaire are included as appendices.

CHAPTER - 2

LITRATURE REVEIW

2.1 Housing Problem in Addis Ababa

It is repeatedly said that, Addis Ababa has complex and multi-faceted problems. Among the socio-economic problems, housing is the critical. The recently launched housing development efforts should be given due attention as they persist to lessen the existing housing shortage in the city, with a magnitude of over 270,000 housing backlog in Addis Ababa. As the housing problem is the major socio-economic problem in the city, the effort requires engaging all stakeholders in addressing the problem and developmental efforts should be seen from different perspectives. Among the problems: general lack of decent houses, imbalance between demand and supply, rising of construction costs and lack of availability of construction materials are highly profound. This entire housing problem needs substantial effort in collaboration between the government and private sectors. Therefore, it is universal to think in lines of large-scale housing schemes. This idea is better implemented if there is a sustained alliance between the government and the private sector. The private sector includes the contractors who actually do the work. The contractor is expected to play a major role in the successful implementation of mass housing by reinforcing its internal strength through appropriate project management. (Article by Addis Ababa City Government Information and Culture Bureau May 25, 2007)

The various studies highlighted suggest that in order to achieve adequate housing delivery, the construction sector needs to be structured and adjusted through implementing appropriate management systems with respect to cost and time analysis (Budget and schedule).

Cost and time management as a long serving discipline throughout the life cycle of developments provides the basis for the establishment of the optimum cost of housing development. Effective and efficient cost and time management is therefore a critical success factor to apply in the practice of housing project.

2.2 Cost and time Controlling Technologies

Efforts targeted at solving the housing problem in Addis Ababa have fallen short of the accumulated demand. Shortage is especially acute for low-income households that account for over 80 percent of the city's population.

Overcrowding and deterioration widely exist. An estimated 60% of the city's core is rundown (decaying), and about a quarter of all housing units have been built informally. The city is also not able to provide adequate services to the additional areas thus discouraging house construction and contributing to the expansion of the slums.

Taking this entire problem into account, it is universal to think about new technology that can effectively reduce cost and delivery time to improve the greater demand of housing in Addis Ababa city and other urban centers.

To attain better life for the cities, the earlier and the prevailing City Administrations are carrying out significant activities in the area of housing development and exerting the best efforts to realize effective housing technology. In any country, housing industry plays a significant role in citizens' life and progress. As a result, the sector needs to be supported by innovative technology. Innovative technology reduces cost, increases production quality and reduce construction period. This, off course, creates favorable environment to supply construction materials in quantity and good quality for the construction activities.

However, in most developing countries, the alarmingly rising cost of construction and lack of materials are among the challenges for the construction industries. This unaffordable price in construction materials is one of the factors that force the city residents to construct illegal low status houses that are usually not in line with the standards of the city plans and finally turn out to be slums.

The rapid urbanization, high population rate, industrial development and high fees for design and construction, house renewal and poor infrastructure are among the factors that strained the use of efficient cost housing technology. Inability to use the above-mentioned basic facilities results in poor quality construction. The poor society like that of Addis Ababa can hardly afford this costly construction and its technology. Thus, it is highly expected that the government policy along with private investment should resolve the difficulties by integrating their finance in construction technology. This huge amount of finance need to be managed properly by implementing structured cost and time controlling system from both parties (client and contractor side).

Utilizing effective and efficient housing technology is meant reducing cost, increasing productivity, improving quality and crushing time. As technology improves, cost will be

reduced and the quality and durability of the houses constructed may be achieved. Beside that, it will respond to the demands of the lower and middle class by building affordable houses.

2.2.1 The Benefits of Low Cost Housing Technology

The technology needs to render awareness rising for individuals who think low cost housing technology of a low quality. Several countries are seen changing agro-industry residue into construction raw materials and utilizing especially to foster their construction. However, as this technology is disposing residues that pollutes the environment and provides options for construction, it needs to be highly encouraged.

As an example, the Addis Ababa City Administration, in collaboration with the Chinese Government, has built an agro-stone (wall panels) industry to promote the housing activity in the city. The agro-stone industry has many benefits, among which the following are main ones:

- It is very cheap
- It reduces the construction cost
- It accelerates the construction process.
- It enables to use local materials
- It will decline the current alarmingly increasing of cement price.
- It utilizes chemicals and residue that may harm the environment.

It is believed that the agro-industry would reduce the current construction costs compared to what the City Administration used to allocate for construction in previous times. The new technology will also create strong ties among sectors that are engaged in the construction and offers opportunity to learn from one another to develop their skills.

Various countries applied diverse mechanisms to use low cost housing technology. As the technology is profitable, various business enterprises may be engaged in it. Training the local community to work with the technology is the primary duty. (Article by Addis Ababa city government information and culture bureau May, 2007)

2.3 Project Management

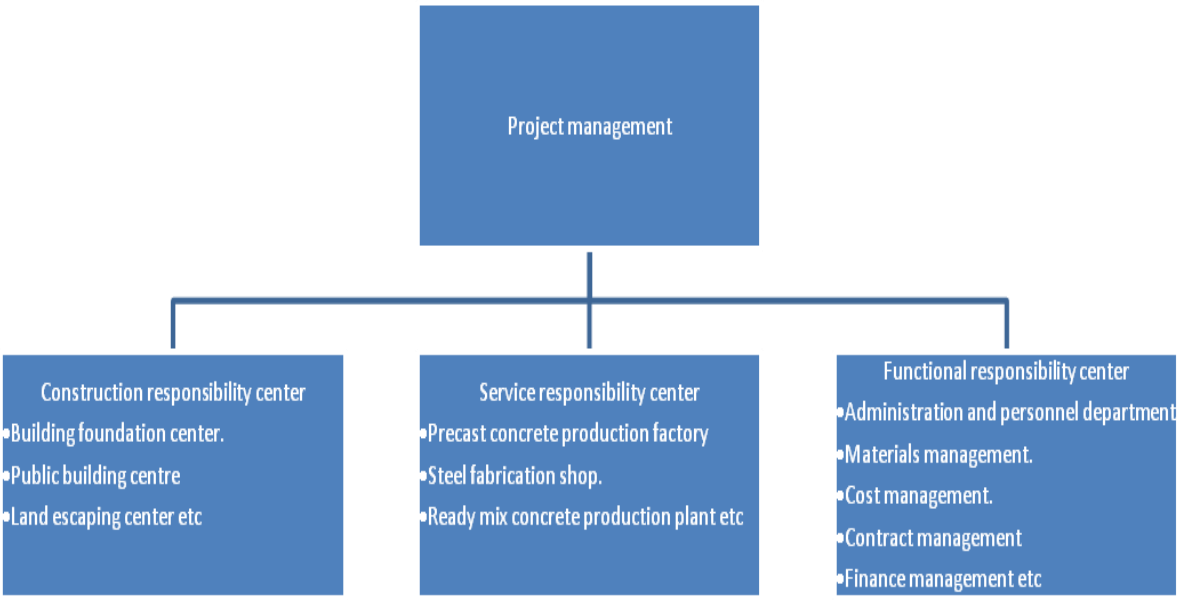
Since it is the basis of my research, I found that it is necessary first to know about project management definition and concept.

Project Management is the art and science of mobilizing and managing people, materials, equipment and money to complete the assigned project work on time with in budgeted cost and specified technical performance standards. Project management in practice is very complex and diverse. It is due to its complexity that it incorporates different professionals. Under project management, there are a number of subdivisions including:

- Project scope management
- Project integration management
- Time management
- Cost management
- Quality management
- Personnel management
- Equipment management
- Risk management etc.

As most of the construction projects are done through the contract system, the project manager who is the representative of the client plays a dominant role. He manages the entire construction process (scope, time, quality…) to achieve the assigned project objectives. He manages the contractor's employed at site, and the site activities, with the help of his supervisory team that reports to him for decisions. When we come to construction management, it is less complex than project management and its role is for the construction activities on the side of the contractor who manages the work execution as well as the resources, and the work forces. The construction manager operates to achieve the contractors' objectives. Management of a construction project mission entails multi directional interaction of dynamic forces represented by its time, resources constraints, and the changing costs. For one project to be successful there are three key factors, of which if one is absent the other two will be affected and then the whole project system become unstable and the objectives will not be achieved, these are Time, Quality, and Cost.

Project management has three main divisions/responsibility centers as shown below



Whether it is a building construction or any other project, project management is accomplished through five management functions. These are project planning, organizing, staffing, directing, and controlling. The focus of this research is on one of this functions (i.e. controlling) and specifically cost and time controlling focusing on cost efficient housing project, this is because there is lots of uncertainty associated with innovative technology, material procurement methods etc. As an introduction it is necessary to put an explanation what controlling is and how controlling done in general. (K.K Chitkara, *Construction project management*, Newdelhi, 2003.)

2.3.1 Project Control

Project control is an action-based process that encourages continual monitoring of operations. To be successful, the actual work with its cost and duration must be completely and accurately documented. Comparisons should be made to project standards and variances noted. To begin the processes of controlling, managers first establish the standards/ plan/ that define success for the construction project. This implies that project-controlling system has two components:

- Standards, and;
- Actuals

Cost, time and quality, which are key determinants for the success of any project, are bases for standards and configured. Indeed, they are measurable and can provide direction to the project. These standards are used to check progress and provide direction. Generally, measurements standards serve as the goals for the project participants.

The second component of the project control system is measurement of actual progress. This includes accurate cost, schedule, and quality information about the project. This actual performance compared to planned performance provides the managers with feedback about how well the project is proceeding. When we come specifically to controlling cost and time /cost and time management system, we have to prepare the project for construction by breaking down the details of work to make it ready for easier controlling. Creating a cost target or a project forecast or schedule (also called cost and time baseline) is the first step in controlling cost and time. (Wubishet Jekale (Dr. Ing.), paper on *'What is LCH-MH?' Approach to construction?'*, 2004.)

2.3.2 Cost and Time Baseline

In order to establish cost and time baseline for a project, the conceptual cost and time estimate, which is the initial cost for a project and expected volume of work converted to working days, is our cost and time base-line. When we come to the contractor, the accepted bid price is the cost baseline for the project and consequently this accepted bid price is the target by which the success of the project will be measured interms of this baseline (cost and

time). If the project scope is well managed and the estimates done well, then the bids received will be close to the prior estimate, project cost and Schedule. This cost baseline and schedule becomes more detailed as the project reaches to construction stage so that the detailed estimate provides direct cost and time targets.

During estimation, the project manager should focus on the most time and cost sensitive parts of the project. As the project proceeds, the actual cost and schedule for the project will change but the baseline will not change and serves as a measure of how the project was planned at the beginning of the project. (Wubishet Jekale (Dr. Ing.), paper on *'What is LCH-MH?' Approach to construction?'*, 2004.)

2.3.3 Project Cost and time Management

Project cost and time management means the process concerned in planning, estimating, budgeting, and controlling cost and time so that the project can be completed with in the approved budget and specified timeframe.

Effective and efficient cost and time management with recent innovations as design improvements is therefore a critical success factor in the implementation of successful housing technologies.

- Planning construction cost and time : it is the part of the of project management plan that produce cost and time management plan. Time and Cost management plan arranges and establishes the criteria for estimating, budgeting, and controlling project cost and time.
- Cost Estimating:-Estimation is a methodology for forecasting and predicting cost and expenditures of a future project and to produce a budget.
- Cost Budgeting: - the summations of the estimated costs of individual activities or work packages to establish a cost base line.
- Schedule: - determination of the duration of each activities based on the output of each volume of work using standards.
- Cost Controlling: - influencing the factors that cause *cost variances* and controlling *changes* to the project budget.
- Time Controlling: - Monitoring of each activities with respect to Schedule to complete the project with in the proposed time line.

The above processes (cost estimating, Schedule, budgeting, and control) are interdependent with each other and other fields. Each process occurs in each phase of the project (In the project's Concept Phase, in the project's Development or Definition Phase and Construction phase). (William J. Bender[1] P.E. and Bilal M. Ayyub[2] P.E.,2007)

2.3.4 Cost and Time Control

Traditionally, cost and time control in the construction industry has not received the attention like other industries due to the unique characteristics of the construction project. Most of the construction companies do not know weather there is an increase or decrease on the price of the contractor's offer, which means the difference between the contractor's offer and the actual price. Due to this uncertainty, construction industry has always been full of claims so there is always a need for proper cost and time controlling mechanism for those who are responsible for cost and time variance.

1 .Cost and time management is the main Duty of Project / or Construction Managers on the clients side;

2. The project Manager calculates not only the Construction costs but also the overall project costs, incl. Consultants fees, additional cost, profits, etc. The Project Manager gets his information on construction costs by the Architects and Engineers, they also prepare the estimates for the single trades. During Construction period the construction cost are monitored on site by the site manager / site supervisor verifying claims, changes, additional costs and controlling them on their implementation.

Cost and time control is a process that is carried out through out the entire life of the project, that means in the following three phases of the project

- In the project's Concept Phase
- In the project's Development or Definition Phase
- The Project's Execution Phase

The clients post contract cost and time control systems are necessary to:

- To enable the client to approve the changes to the cost and time extension before such instructions modifying the works given to the contractor.
- To enable the client to budget effectively for the anticipated work.
- To enable the cost and time effect of any major change to be seen in the context of project as a whole.
- Post to enable avoiding action to be taken if the total cost and period appears to be escalating unduly.
- Trustworthy handling and transfer of budgets
- To give maximum transparency on the prices, performances, changes, etc.
- There must be compatibility between the cost and time control system on all sides using a unique structure in cost and time management.

Cost and time control during the construction process is very important to ensure the successful completion (with in the budget allocated and time frame) of the project. Most projects share the common character that they are filled with risks and uncertainty that can cause cost escalation and time extension especially housing project that it needs proper assessments of cost of each resource. Construction project manager and cost engineers have a responsibility to execute the work with in a budget allocated to the project.

However, this research is focused on only the third area, which is controlling the cost and time during the projects execution /construction/ phase.

Construction and cost engineering professionals have long recognized the need for improvements in the area of cost and time control. Managing cost and time includes estimating, budgeting, and controlling and finally taking measures to correct a cost and time overrun problem. Several cost and time control techniques are being used by the construction industry to varying degrees. These are exception reporting, trend analysis, earned value, range estimating, and forecast unit cost. Except earned value, other cost control techniques tend to focus on variances in line items once the cost and time overrun has been occurred. What is needed is that a cost control methodology that tells us potential cost issues and

provides project managers warning before their occurrence. (William J. Bender[3] P.E. and Bilal M. Ayyub[4] P.E.,2007)

Cost and control can be called effective and efficient if the management:

- Implement efficient cost and time control procedures and systems
- Develops and updates the control estimate
- Analyze cost and time trends to discover potential problems and takes remedial measures to control.
- Encourage a cost conscience and time conscience attitude
- Continuously examines methods of execution with an object of total project reduction

The cost, at each level, may be divided in to the following cost element

A. Direct man power costs
B. Direct material at site delivered cost.
C. Direct equipment, plant and service costs
D. Sub contract cost
E. Indirect site costs

2.3.4.1 The Cost Control Problem

During the execution of a project, procedures for project control and record keeping become vital tools to managers and other participants in the construction process. These tools serve the dual purpose of recording the financial transactions that occur as well as giving managers an indication of the progress and problems associated with a project. The problems of project control are aptly summed up in an old definition of a project as "any collection of vaguely related activities that are ninety percent complete, over budget and late." The task of project control systems is to give a fair indication of the existence and the extent of such problems.

In this part of conceptual review, we consider the problems associated with resource utilization, accounting, monitoring and control during a project. In this discussion, we

emphasize the project management uses of accounting information. Interpretation of project accounts is generally not straightforward until a project is completed, and then it is too late to influence project management. Even after completion of a project, the accounting results may be confusing. Hence, managers need to know how to interpret accounting information for the purpose of project management. In the process of considering management problems, however, we shall discuss some of the common accounting systems and conventions, although our purpose is not to provide a comprehensive survey of accounting procedures.

The limited objective of project control deserves emphasis. Project control procedures are primarily intended to identify deviations from the project plan rather than to suggest possible areas for cost savings. This characteristic reflects the advanced stage at which project control becomes important. The time at which major cost savings can be achieved is during planning and design for the project. During the actual construction, changes are likely to delay the project and lead to inordinate cost increases. As a result, the focus of project control is on fulfilling the original design plans or indicating deviations from these plans, rather than on searching for significant improvements and cost savings. It is only when a rescue operation is required major changes will normally occur in the construction plan.

"Finally, the issues associated with integration of information will require some discussion. Project management activities and functional concerns are intimately linked, yet the techniques used in many instances do not facilitate comprehensive or integrated consideration of project activities. For example, schedule information and cost accounts are usually kept separately. As a result, project managers themselves must synthesize a comprehensive view from the different reports on the project plus their own field observations. In particular, managers are often forced to infer the cost impacts of schedule changes, rather than being provided with aids for this process. Communication or integration of various types of information can serve a number of useful purposes, although it does require special attention in the establishment of project control procedures". (project management for construction cost control, monitoring and accounting 2006)

2.3.4.2 Project Cost and Time Control Concept

First, you establish a set of reference *baselines.* Then, as work progresses, you *monitor* the work, *analyze* the findings, *forecast* the end results and *compare* those with the reference

baselines. If the results are not satisfactory then you make *adjustments* as necessary to the work in progress, and repeat the cycle at suitable intervals. If the results get out of line with the baseline plan, you may have to *change* the plan. More likely, there will be scope changes that change the reference baseline, which means that every time that happen you have to change the baseline plan. This cost and time control concept is best illustrated in the following diagram.

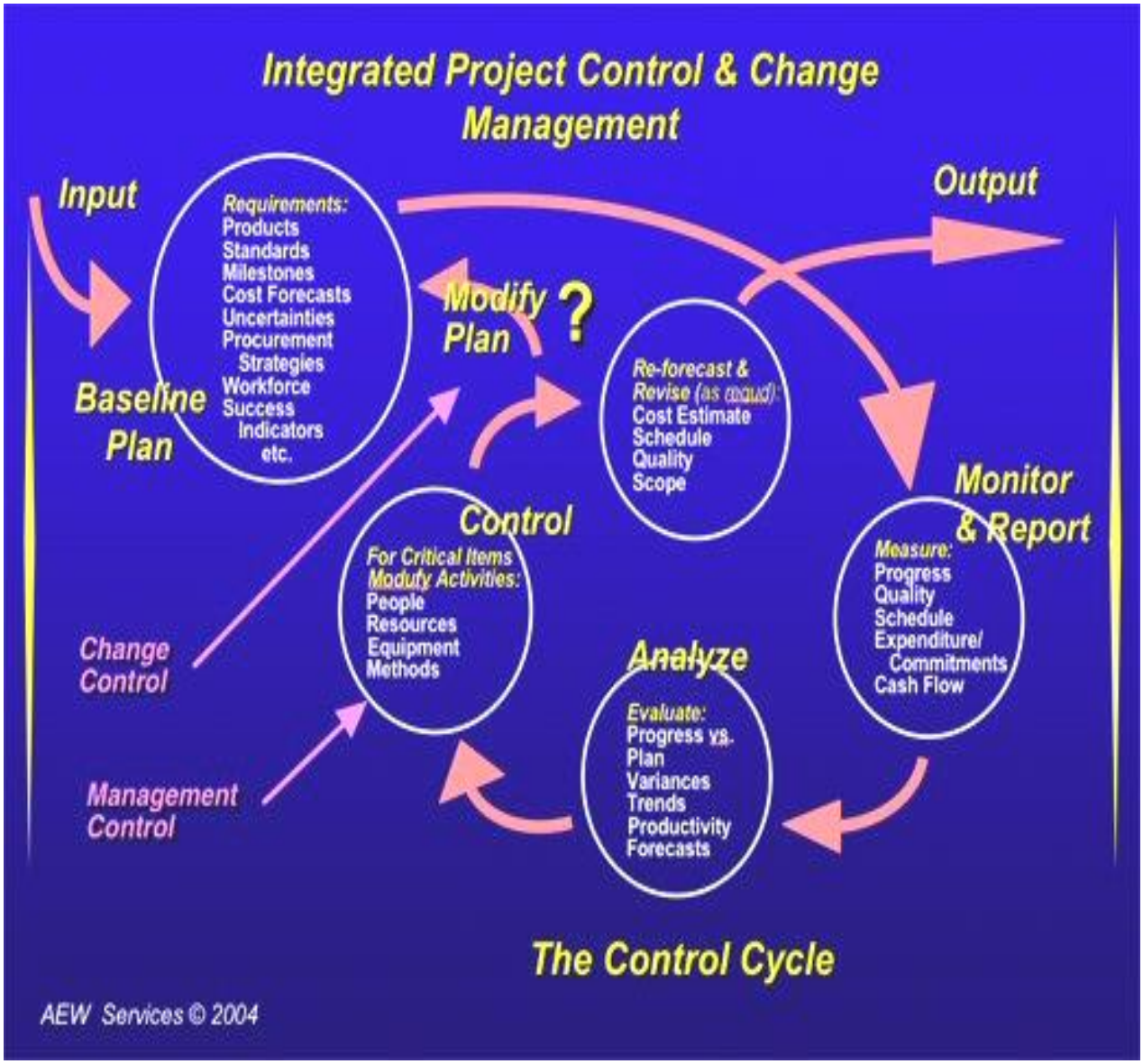


Figure - 1 cost and time control concept **(** R.Max Wideman N.J.Smith, *Engineering Project Management*, UK, 1998.)

2.3.4.3 The Purpose of Cost Control

Cost control is useful in the construction industry field because of the high level of uncertainty associated with the cost of building complex structures special building like low cost hosing project. Although there is a potential for projects to be completed under budget the complexity involved in construction requires specific attention to cost control in order for the successful completion of the project. To be the most effective over the lifecycle of a project a cost control system must be applicable for all the three phases of the project that we have mentioned above. The system needs to be simple enough that it is applicable and enough to apply to a wide of projects. The most important use of cost control is:-

- Giving day to day attention for each activity that are on the contract to make it on the safe side and also over all financial assessment, monthly valuation for completed work at a regular interval.
- To provide feedback to the cost estimator for tendering purpose. But it is less important due to the unique nature of the construction industry and higher variation of price of material, labor, and equipment from day to day, month to month, year to year and also variations of contracts for different projects.
- Provide data for the valuation of variation that may occur during the course of contract.

This use of cost control also needs proper recording of previous data. Cost control also includes controlling the cost of material, labor, and equipment (direct costs) and other indirect costs (site overhead and general overhead costs). Material cost control is simple and direct forward to perform but if the amount of material on site is large it need accurate and frequent interval assessment.

Cost control of labor and equipment are very important rather than material this is due to these two reasons

- Their combination /combination between labor and equipment/ are very important to the successful execution of the work on the site.
- Their interaction is most likely to be inefficient

As explained earlier, cost estimating, budgeting, and controlling are highly interacting each other. Ones output is used as an input for the other as cost-estimating output is the input for cost budgeting and cost control. So the input for cost control /the output for cost estimating and budgeting/ shall be as accurate as possible for best cost control.

Project cost control includes:

- Influencing the factors that create changes to the cost baseline
- Ensuring requested changes are agreed upon
- Managing the actual changes when and as they occur
- Assuring that potential cost overruns do not exceed the authorized funding periodically and in total for the project
- Recording all appropriate changes accurately against cost baseline
- Preventing all incorrect, inappropriate, or unapproved changes from being included in the reported cost or resource usage
- Informing appropriate stakeholders of approved changes
- Acting to bring expected cost overruns within acceptable limits

Project cost control searches out the causes of positive and negative variances and is part of integrated change control .For example, inappropriate responses to cost variances can causes quality or schedule problems or produce an unacceptable level of risk later in the project.

2.3.4.4 Cost Control type

2.3.4.4.1 Direct Cost control

Direct cost control aims at improving productivity by minimizing the wastage of input resources, developing standards for costing future works, and accounting all direct costs for cost control. Direct cost control can best be exercised at the lower organizational level at the production center, where cost is actually incurred. Direct cost controlling is exercised by

comparing the actual direct cost with the standard direct cost, analyzing the reasons for variation, and applying corrective actions to improve the performance.

Direct cost control involves the evaluation and analysis of the following variances:

a. Direct cost variance
b. Direct materials cost variance
c. Direct labor cost variance
d. Direct equipment cost variance and others

Cost variance can result from many causes. Some of are

- Material price escalation
- Material usage variances
- Labor rate variances
- Labor operating variances
- Equipment rate variances
- Equipment operating variances and others

2.3.4.4.2 Causes of unfavorable Direct Cost Variance

Direct cost control and resource productivity control are inseparable. The object of direct cost control is to minimize expenditure through cost variance analysis, and this mainly depends upon minimizing wastage in the employment of resources.

Cost variance can result from many causes: some of the main causes for unfavorable variances are listed under

- Material price variance: - this include increase price, unplanned purchase. In cost efficient housing project, material price is not a nuisance for the contractor because the client fascinates the material price intensification.
- Material usage variance:- sub-standard materials, undue wastage in the material that they use.
- Labor rate variance: - wage increase, labor associated increases etc
- Labor operating variance: - sub-standard materials used, inappropriate labor skills, lack of work preparation, etc. that results lower in productivity

- Equipment rate variance: -higher hiring charges, incorrect matching of machine with the job.
- Equipment operating variance: -rise in fuel prices, excessive repairs, unplanned idle time etc that lower productivity.

In addition, there are other reasons that create cost variance/deviation from the baseline

2.3.4.4.3 Indirect cost control

Production cost constitutes direct costs and indirect costs. Even if indirect cost accounts for a lesser portion of the project costs, it should be controlled to prevent cost overrun. Indirect cost can be broadly divided in to two categories

1. Production related variable overhead: this includes construction center variable over heads, service center variable overhead and administration center overheads
2. Time related periodic fixed over heads: this includes project fixed over heads

In addition, causes of indirect cost variances are

- Construction centered variable overhead
- Service center variable overhead
- Administration center variable overhead
- Project fixed overhead

2.3.4.5 Project Time control

Project schedule is the key for the controlling the project for the on time completion of the project. There are different ways of approaching in scheduling a given project and it is the responsibility of the contractor to choose based on the project condition.

Accordingly, schedules must be prepared based on actual site conditions in consideration to Location of the project where climatic conditions would be significant, Efficiency of the equipment and manpower allocations.

2.4 Cost and time Control Inputs, Tools and Techniques.

2.4.1 Cost Control Inputs.

The following are cost control inputs

- Cost baseline:-is a time-phased budget that is used as a basis against which to measure, monitor, and control over all cost performance on the project. It is developed by summing estimated costs by period and is usually displayed in the form of S-curve

Project Funding Requirement: - are derived from the cost base line and can be established to exceed, usually by a margin, to allow for either early progress or cost overruns. Funding usually occurs in incremental amounts that are not continues, and therefore appears as step function. The total fund required are those included in the cost baseline plus the management contingency reserve amount. Some portion of the management contingency reserve can be included incrementally in each funding step or funded when needed, depending on organizational policies.

- Performance Report:-performance reports provide information on cost and resource performance because of actual work progress.
- Work Performance Information: - work performance information concerning to the status and cost of project activities being performed is collected. This information includes, but is not limited to:
- Deliverables that have been completed and those not yet completed
- Costs authorized and incurred
- Estimates to complete the schedule activities
- Percent physically complete of the schedule activities
- Approved Change Request: - approved change requests from the integrated change control process can include modifications to the cost terms of the contract, project scope, cost baseline, or cost management plan.
- Project Management Plan: -the project management plan and its cost management plan component and other subsidiary plans are considered when performing the cost control process.

2.4.2 Cost and Time Control Tools and Techniques

A. Cost and Time Change Control System: - a cost and time change control system, documented in the cost management plan, defines the procedure by which the cost baseline can be changed. It includes the forms, documentation, tracking systems, and approval levels

necessary for authorizing changes. The cost and time change control system is integrated with the integrated change control process.

B. Performance Measurement Analysis:-performance measurement techniques help to assess the *magnitude of any variance* that will invariably occur. An important part of cost and time control is to determine the cause of a variance, the magnitude of the variance, and to decide if the variance requires corrective action. The earned value technique involves developing these key values for each schedule activity, work package, or control account

2.4.2.1 Earned Value Management

Earned Value Management (EVM) is a project management technique that measures forward progress objectively. EVM has the unique ability to combine measurements of technical performance (i.e., accomplishment of planned work), schedule performance (i.e., behind/ahead of schedule), and cost performance (i.e., under/over budget) within a single integrated methodology. EVM provides an early warning of performance problems while there is time for corrective action. In addition, EVM improves the definition of project scope, prevents scope creep, communicates objective progress to stakeholders, and keeps the project team focused on achieving progress. The *principle* of EVM does not depend on the size or complexity of the project. However, the implementations of EVM can vary significantly depending on the circumstances. (www.wikipedia.org)

Key questions that EVM answers

- Are we on schedule?
- Are we on cost?
- What are the significant variances?
- Why do we have variances?
- Who is responsible?
- What is the trend to date?
- When will we finish?
- What will it cost at the end?
- How can we control the trend?

However, for this paper only the cost aspect is being focused

1. Planned value (PV): - is the budgeted cost for the work scheduled to be completed on an activity or WBS component up to a given point in time.
2. Earned Value (EV): - is the budgeted amount for the work actually completed on the schedule activity or WBS component during a given time period.

$$EV = \%Complete * BAC$$

or

$$EV = \sum_{Beginning}^{Current} PV_{WorkElementsCompleted}$$

If we have the necessary details, another control tool that we can adopt for monitoring ongoing work is the "Earned Value" (EV) technique. This is a considerable art and science that we must learn about from texts dedicated to the subject. However, essentially, you take the costs of the schedule activities and plot them as a cumulative total on the appropriate time base. Again, you can do this at the activity level, WP level or the whole project level. The lower the level the more control information you have available but the more work you get involved in. Either way, the result is a curve in the shape of an "S", known as an "S-curve".

3. Actual Cost (AC): - is the total cost incurred in accomplishing work on the schedule activity or WBS component during a given time period. This AC must correspond in definition and coverage to whatever was budgeted for the PV and EV.

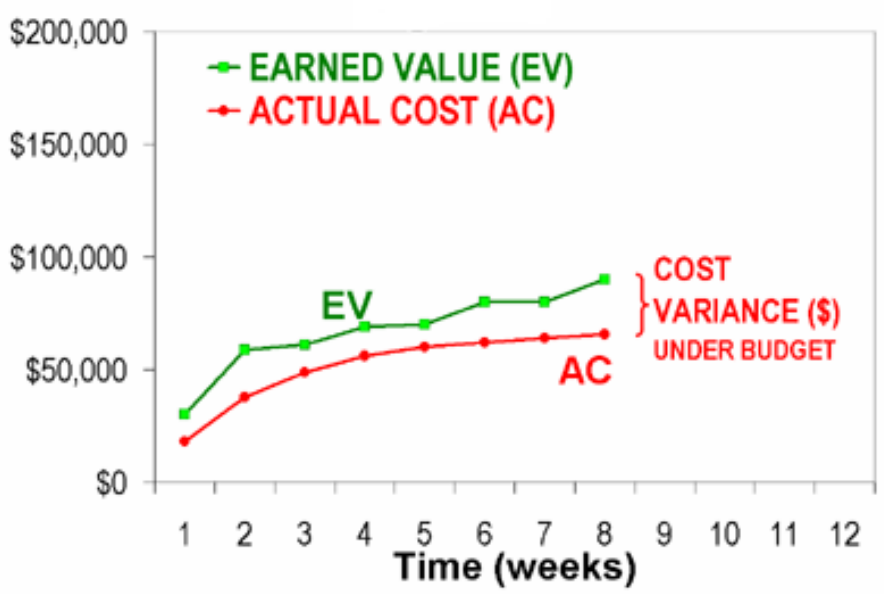


Figure 2

The above figure shows the same EV curve (in green) with the actual cost data (in red). It can be seen that the project was actually under budget, relative to the amount of work accomplished, since the start of the project.

2.4.3 Monitoring and Analyzing Earned value project metrics

Using Earned value metrics, the contractor can accurately monitor and measure the performance of its projects against a firm baseline. Measurement will take place at regular intervals may be monthly, but oftentimes weekly—where, as of a given point in time, the project will be determining: its Planned value its Earned value, and the Actual Costs incurred. These three dimensions provide the performance the project. Using the three dimensions of Earned value, the project management teams can at all times monitor the cost performance status of their projects.

To determine our cost position, we must also start with our measured Earned value, but now we subtract the Actual Costs incurred to accomplish the earned value. A negative value indicates that we are overrunning our cost that is very serious. Keep in mind that our best planning, scheduling, and budgets will be front-loaded into the early phases of the project.

Thus, if we overrun the early phases of the project, how can we expect to recover the overrun in the latter phases when the plans, schedules, and budgets are more uncertain?

Five Basic Performance Questions &Answers

- Estimate at Completion: - What do we now expect the total job to cost?
- Budget at Completion (BAC): - The total planned value (PV or BCWS) at the end of the project. If a project has a Management Reserve (MR), it is typically in addition to the BAC.
- Actual Cost of Work Performed (ACWP or AC): - How much did the completed work cost?
- Budgeted Cost for Work Performed (BCWP or EV): - How much work was done?
- Budgeted Cost for Work Scheduled (BCWS or PV): - How much work did we plan to do?

1. Cost variance: - is equal to

   CV=EV-AC

2. Schedule variance: - is equal to

   SV=EV-PV

3. Cost performance index (CPI): -

$$CPI = \frac{BCWP}{ACWP}$$

< 1 means that the cost of completing the work is higher than planned (bad)

= 1 means that the cost of completing the work is right on plan (good)

> 1 means that the cost of completing the work is less than planned (good or sometimes bad).

4. Cumulative CPI: - used to forecast project cost at completion

   $CPI^c = EV^c/AC^c$

5. Schedule performance index: - is used to predict the completion date and in conjunction with CPI to forecast the project completion estimate. SPI= EV/PV

SPI= EV/PV

Forecasting - it includes making estimate and predictions of conditions in the projects future based on information and knowledge available at the time of forecast.

Forecasting technique helps to assess the cost or the amount of work to complete the schedule. For forecasting purpose, we use the following formula.

- Estimate to complete based on new estimate: -is the revised estimate for the work remaining.
- Estimate to complete based on a typical variances: -this is used when current variance are seen as typical and the project management team expectation are that similar variance will not occur in the future

  $ETC=BAC-EV^c$
- Estimate to complete based on typical variance: -used when current variances are seen as typical of future variances

  $ETC= (BAC-EV^c)/ CPI^c$

There are also other measures of performance

Project performance review: performance reviews compare cost performance over time. Performance reviews are used to assess schedule activities, work packages, or cost account status and progress or weather there is cost overrun or under run with the following technique.

- Variance analysis: -comparing actual project performance to planned performance
- Trend analysis: -is used to examine project performance over time to determine if performance is improving or deteriorating.
- Earned value technique: - it compares planned performance to actual performance

Project management software: -such as computerized spreadsheet, is used to monitor PV versus AC and to forecast the effect of change or variance

Variance management: - the cost management plan describes how cost variances will be managed. Finally the output of the cost control is updates cost estimate, updates cost baseline, performance measurement, forecasted completion, requested completion, recommended corrective action, organizational process asset, and project management plan.

2.4.4 Cost and Time Run Reports

Cost reports are generally initiated at the level of responsibly centers. Preferably, cost and time reports should be initiated monthly and their frequency can be increased in the early stage of the project.

2.4.5 Change order management

In project management, a change order is a component of the change management process, whereby changes from the agreed upon scope (limitations) of the project's work require a mutual agreement.

Change orders are common to most projects, and very common with large projects. After the original scope (or contract) is formed, complete with the total price to be paid and the specific work to be completed, a client may decide that the original plans do not best represent his definition for the finished project. Accordingly, the client will suggest an alternate approach.

Common causes for change orders to be created are:

- The project's work was incorrectly estimated
- The customer or project team discovers obstacles or possible efficiencies that require them to deviate from the original plan
- The customer or project team are inefficient or incapable of completing their required deliverables within budget, and additional money, time, or resources must be added to the project
- During the course of the project, additional features or options are perceived and requested.

A project manager then typically generates a change order that describes the new work to be done (or not done in some cases), and the price to be paid for this new work. Once this change order is submitted and approved, it generally serves to alter the original contract such that the change order now becomes part of the contract.

2.4.6 Construction Cost and Time Risks

The construction cost and time risks can be broadly grouped under the following categories:

Technical Risks

- Incomplete design.
- Inadequate site investigation.
- Uncertainty over the source and availability of materials.
- Appropriateness of specifications.

Design faults

- Misunderstanding the client's brief to develop the design
- Using information which is incorrect or out of date
- Misunderstanding of the client's expectations of quality standards
- Lack of co-ordination between the designers.
- Loose or inappropriate specifications

Construction faults

- Not building to drawings or specifications
- Poor supervision leading to bad workmanship
- Insufficient management of the quality of construction.

In order to eliminate those potential problems many clients have looked to quality assurance to reassure them that they will get the right building without undue quality problems.

Logistical Risks

- Availability of resources - particularly construction equipment's, spares parts, fuel and labor.
- Availability of sufficient transportation facilities.

Construction Risks

- Uncertain productivity of resources.
- Weather and seasonal implications.
- Industrial relations problems.

Financial Risks

- Inflation.
- Availability and fluctuation in foreign exchange.
- Delay in Payment.
- Local taxes. (source: Prof. Ingo Becker's lecture notes)

CHAPTER - 3

METHODOLOGY

Research is a systematic investigation to find answer to a problem: At the same time research is also a process for collecting, analyzing and interpreting information to provide solution to queries. (Wubeshet, 2000), citing Burn (2004), Kumar (1999)

Based on the above definition this research is conducted to contribute knowledge by addressing the following research question:

1) What cost and time control tool and technique do contractors working to complete projects on effective and efficient manner?
2) What are the main factors that create cost and time variance and result in cost and time overrun?

The research design uses both primary and secondary data. The research strategy is known to perform two main functions: conceptualizing an operational plan and ensuring the validity and reliability of this operational plan to the research question.

Data sources include primary and secondary data's. Primary data will be obtained from questionnaire to contractors. Thoroughly studying and investigating documents obtained from organizations involved in CEH (LCH) projects will obtain secondary data.

3.1 Method of The study

Qualitative and quantitative methods have been applied in the study. The scope of this survey encompasses the participants who are involved in the construction of cost efficient housing project, basically the contractor.

3.2 Research Instrument

Questionnaire method is used as a research technique or instrument to gather data from the respondents in the research sample. Questionnaires were prepared and distributed to contractors professional with an in depth knowledge about the issue in question.

The distributed questionnaire includes objective of the research and they are structured to:

- Identifying the major causes of cost and time variances
- Asses the cost and time controlling tool and techniques

- Asses methods that they use to forecast, to monitor cost and time performance and to record incurred cost
- How they agreed with the cost and time variance and cost and time overrun in order not to occur

For simplicity, easy understanding of the questionnaire by our respondent and ease of analysis and conclusion several questions are in table form and quantified and percentiles form.

Formal and informal discussions were made with key respondents

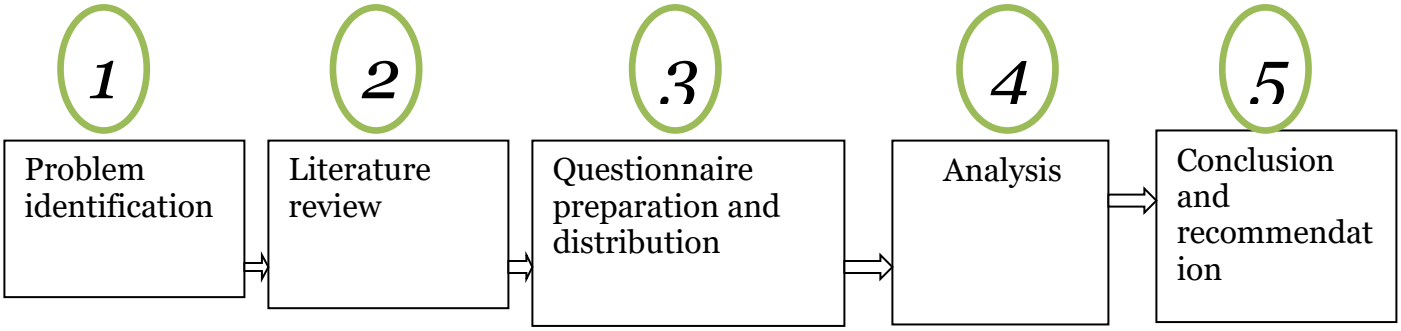
3.3 Data Collection Techniques

Variety of contractors are selected for the questionnaire from grade one to five in both categories and 18 semi-structured questions were prepared which are relevant for this Project. During answering the questionnaire, every effort was made by appointing a clarification date for those who need further clarification about the subject matter. There also some questions that are not filled due to limited knowledge towards the question.

3.4 Data Analysis

Analysis of the collected data is conducted to identify the main causes of cost and time variance, to assess the cost and time controlling mechanism and how they approach if they are appeared once.

Generally, the following figure illustrates the idealized procedure implemented to the research methodology.



CHAPTER -4

ANALYSIS, DISCUSSION AND RESULTS

4.1 preliminary remarks

The following analysis from the questionnaire was used only for the purpose of this thesis!

- The questionnaire were presented with questions designed to know the causes of cost and time variance and that creates cost and time overrun and identify major cost and time risks and the associated measure they use, analyze the tools and technique
- The question were designed and distributed to the contractor involved in LCH, Housing projects
- 16 semi-structured questions are distributed to the contractor, out of this 13 are returned this means the return is about 81.25%. Among the returned 3 are far from the reality they are filled in randomly and were neglected.

In this research, the analysis part is based on the responses that I found from the questionnaire distributed and the discussion from the analysis is presented together for a better flow of ideas. The analysis is divided into sub topics according to the divisions made in the literature review and as presented in the questionnaire. During preparation of the questionnaire, I have selected the major (key) variables in the literature part and prepared the questions in order to achieve our objectives and the analysis is made on these selected variables. The responses from respondents are shown using bar charts and additional explanations are given to the bar charts. When we draw charts, we use the information from those respondents who have finished the questionnaire better and irrelevant answers from respondents are rejected.

4.2 Cost and time variances

As stated earlier in the literature review, there are many factors that create cost and time variance. In my Questionnaires, I have categorized these factors into two. Those that create direct cost and time variance and other factors that create indirect cost and time variance. Among the factors that create direct cost variance the major ones are labor rate, shortage of material in the market (material scarcity), productivity and others. About 78% of the causes of cost variation is due to these factors (labor rate scarcity of materials and productivity problems). According to the respondents' answers, as shown in the Pie chart bellow, the labor

rate variance is the main factors that create direct cost variance in their project. Because, in cost efficient housing projects contractors get the profit by using labor-intensive method of construction. This implies, increasing labor rate directly affects the total project cost. As the respondents said, this increment of labor rate is related to the current economic condition of the country (due to inflation).The Other cause for time to deviate from the original time frame is delivery of basic material specifically cement, Reinforcement bar, sanitary and electrical fixtures since AAHPO is responsible for the provision of these materials.

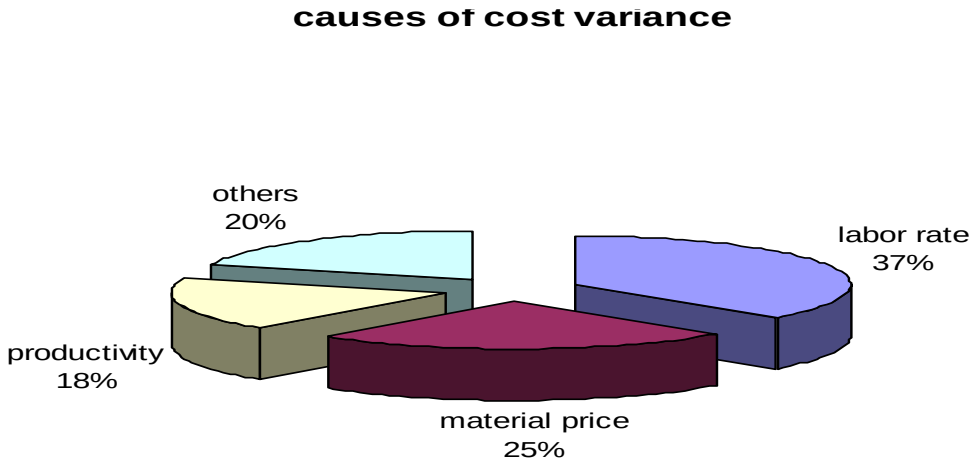
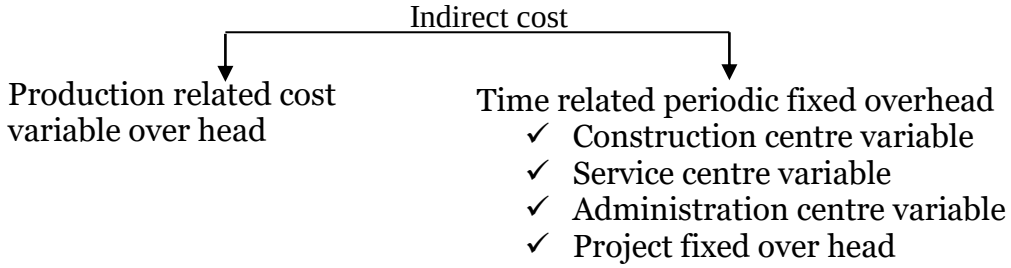


Fig.3. Major causes for the variation of direct costs

The second major factor for cost and time variation is scarcity of materials in the market which results in price escalation, untimely delivery of materials (cement reinforcement bar and gravel) and also affects the micro and small enterprises not to deliver HCB and precast floor beams on time. This scarcity of materials is due to imbalance between supply and demand. That is, boosting of construction projects (especially housing projects) while the production of basic construction materials remains the same , is the cause for the imbalance between supply and demand .As the respondents said, specifically shortage of cement is the major problem for the delay of housing projects.

As shown in the chart the first major cause for the variation of direct costs is labor. But practically as the market is observed and also as it is the major component of construction works, material price should be the first major cause of cost variation. The difference comes due to the fact that, in housing projects the client (housing agency) delivers the basic construction materials such as cement, reinforcement bars and gravel so that contractors do not have to worry about the variation of these material prices and they are mainly concerned with the other materials like sand and others. Basically, this shows that the major factor for their cost variation and consequently their projects' cost overrun is, labor instead of material and improper delivery will lead to time over of the project. Some respondents told me informally that cement and re bar delivery will lag a month or two, which affects the completion date far behind.

The other factor which results in cost overrun is the productivity problem which can be either labor productivity or crew productivity or both. The labor productivity decline gives rise to the problem of crew productivity. This problem needs coordinating and motivating workers by skilled gang leaders to improve the productivity of laborers and also the crew as a whole.



From my respondents 37% are due to project fixed overhead and 63% are due to project variable overhead costs. As we compare to literature review it is the same

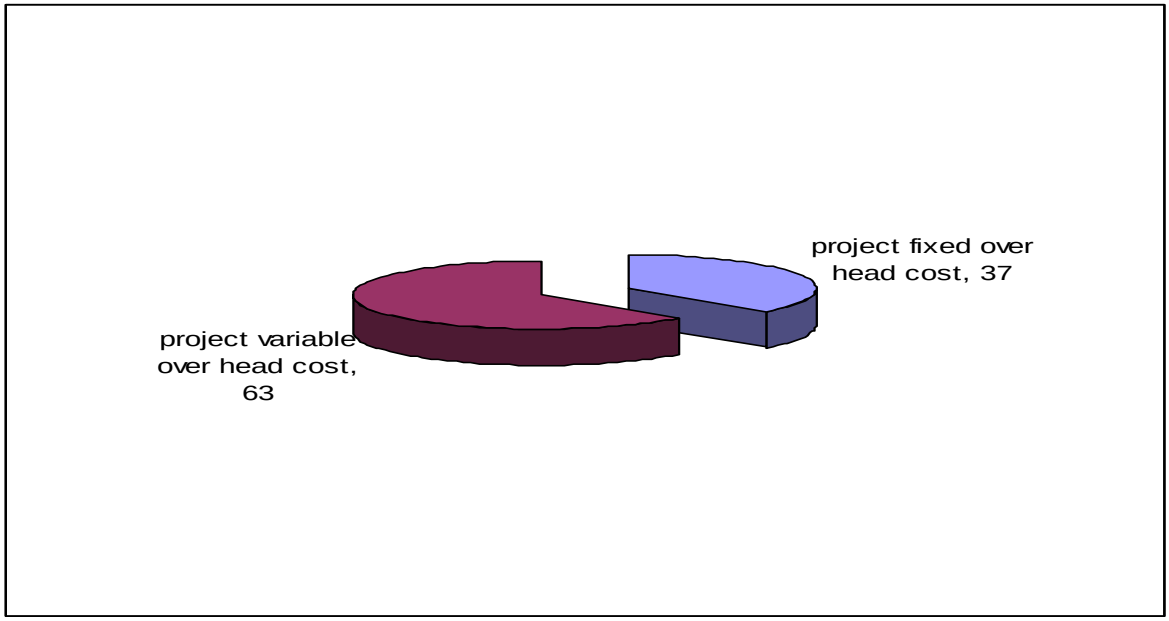


Fig.4 indirect cost variables

Untimely delivery of materials: As explained above, scarcity of materials results in price escalation and delay of projects. Delay of projects is due to the untimely delivery of materials. From the respondents (contractors working in cost efficient housing projects), project delay due to the untimely delivery of construction materials is the major problem for the variation of total project cost and time. When there is untimely delivery of materials especially those delivered by the client, housing agency (cement, reinforcement bars, and gravel) there will be high cost overrun of overheads (administrative costs and other indirect costs). This is due to the idle work force and idle equipments.

In order to compensate the loss due to untimely delivery of materials; contractors (respondents) take different measures. The first measure is to provide incentives for workers to work more than eight hours per day and to work on Sundays and holydays when there is sufficient material available. The second measure they took in order to compensate the loss due to untimely delivery of materials is to sublet by piece rate system. This is done when there is sufficient material supply; the prime contractors sublet some portion of the work to sub contractors without affecting their profit margin. This has the advantage of saving time so

that they will be able to minimize the consequences of untimely delivery of materials by accomplishing their project work on time. The contractors will also be free from overloading of works when they sublet some portion of the work. (E.g. Contractors in cost efficient housing projects use to sublet the concrete work, block work, formwork, plastering). Even though most of the contractors use subcontracting by piece rate system and incentives, some contractors use other alternatives as increasing unit prices firing the employee and so on.

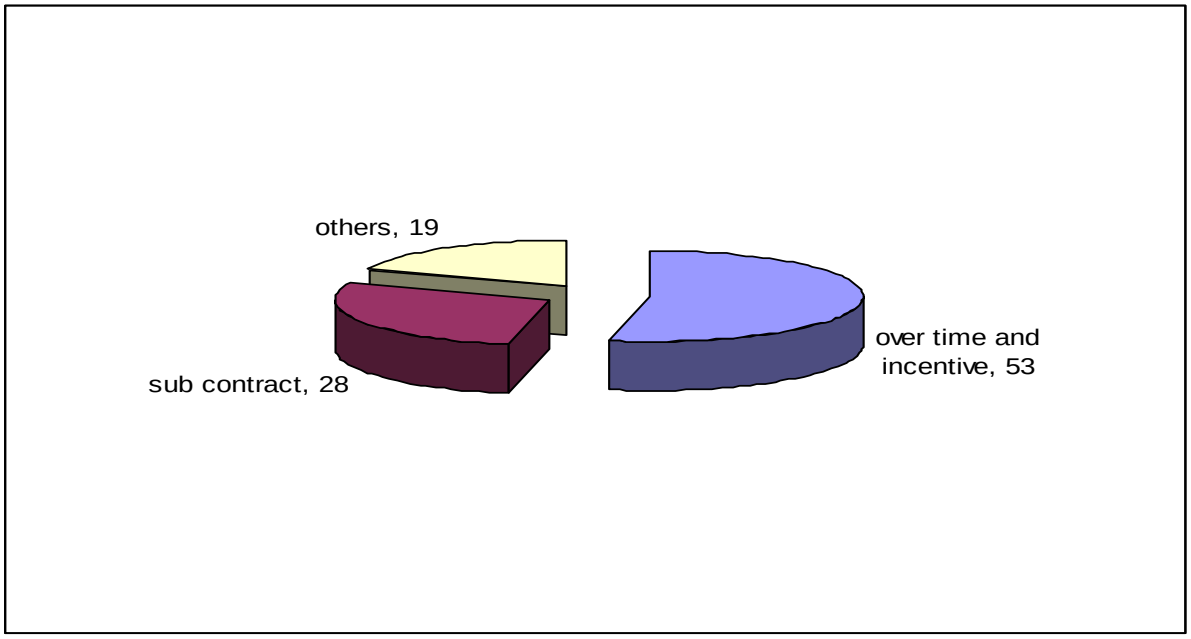


Fig. 5 Measures taken for the loss due to untimely delivery of materials

Cost overrun: As stated in the literature when we say there is cost overrun in a construction or other projects, it is to mean that the actual cost for the work executed is higher than the budgeted cost. As the respondents said, the cost overrun in cost efficient housing projects is due to cost variations discussed above. This implies cost overrun is one of the consequences of cost variations.

Factors that cause cost overrun are similar to the factors that cause cost variation but their magnitude varies accordingly. Of the factors that cause cost overrun, the major ones by their magnitude of impact according to the respondents are: labor rate variation (increasing almost by 50%), shortage of materials in the market, change orders and others as mismanagement of resources equipment renting price escalation, etc. As most contractors said, the labor market

today is much more higher than the expected rate by the time the contract was made. This implies that there is cost overrun on the total project. As the contractors working under housing projects use labor-intensive mechanism of construction, it is a loss to the contractors as the labor rate increases by half. From our respondents, this labor rate increment is due to boosting of construction (housing projects and others construction works) in addition to the economic factors (inflation) both occurred at the same time. The second major factor, which leads to cost and time overrun in housing projects is, the shortage of materials in the market. This is directly related to the capacity of production and supply of products to the market. If there is no sufficient material supply in the market, the project will be stopped and delayed unexpectedly and other costs (overhead costs) also increase without any work. This will automatically create cost and time overruns. As the respondents said, this shortage of materials is due to the rise of demand of construction materials while the production (supply) of materials remains the same. The other major factor for cost and time overrun is change order, which is directly related to design change. According to our literature review, the main causes of change order are:

(1) The project was incorrectly estimated.
(2) The customer or the project team discovers obstacles or possible efficiencies that require them to deviate from the original plan,
(3) The customer or the project team is inefficient or in capable of completing their required deliverables with in the budget, and additional money, time or resources will be added to the project.

Compared to other building constructions, Housing projects are less affected by design changes. But there are some changes and improvements to the original design. Soil investigation has to be made for every site to determine the profile of sub surface condition and then design should be prepared accordingly. The design of housing project mostly prepared in bulk without detail investigation inducing design change, which will intern create cost and time overrun. For example, there was a problem of subsurface ground water on jemo site buildings to change the foundation from isolated to mat inducing additional cost and time since the methodology is completely different. As the problems stated in the literature, the major ones which occur in housing projects are: (1) the customer discovers obstacles that

require to deviate from the original plan. For example, the aesthetical (2) the project team , contractors, are incapable of completing their required deliverables within the budget and additional money must be added to the project. as the respondents said from CEH projects said, financiers ,banks or other financial institutes are not reliable and not as they are before (at the projects beginning) so they guarantee less than expected and the contractors become incapable of completing their required deliverables within the budget .

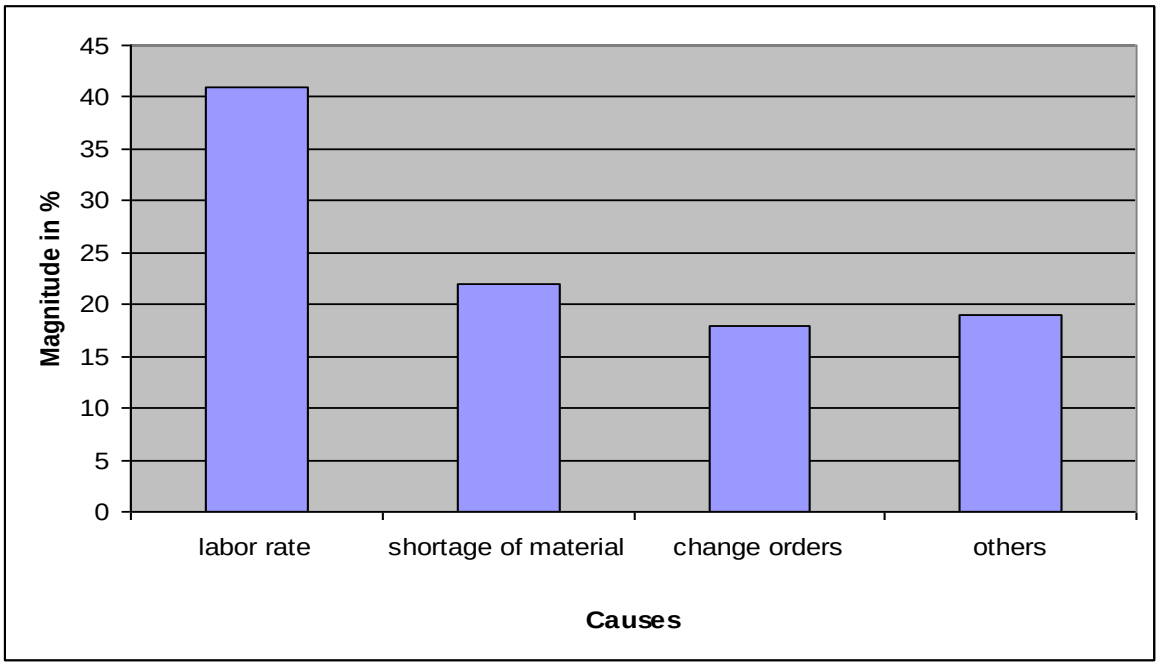


Fig.6. Causes of cost and time overrun in cost efficient housing projects

According to our literature, the measures to be taken for cost and time overrun not to occur or to reduce the magnitude of impact after the problem has occurred are: proper measurement of performance, to change the cost and time base line according to the need of planning changes, forecasting the company's cost position using structured earned value technique etc. out of the respondents in the housing projects, most of the contractors (about 52%) prevent re occurrence of cost and time overrun by comparing the performed activity with the previous records, increasing unit prices (As some of the items in the bill of quantities are not always

achievable, some of the contractors (about 25%) compensate their cost and time overrun from the remaining works by increasing unit prices). And also some of them by subcontracting and following the quality of sub contracted works with proper supervision .As stated in the literature review, even though earned value technique is used by most of the contractors to control cost and time they do not know it (respondents) and it is not by formal way and not following its procedures to get benefit properly from the technique.

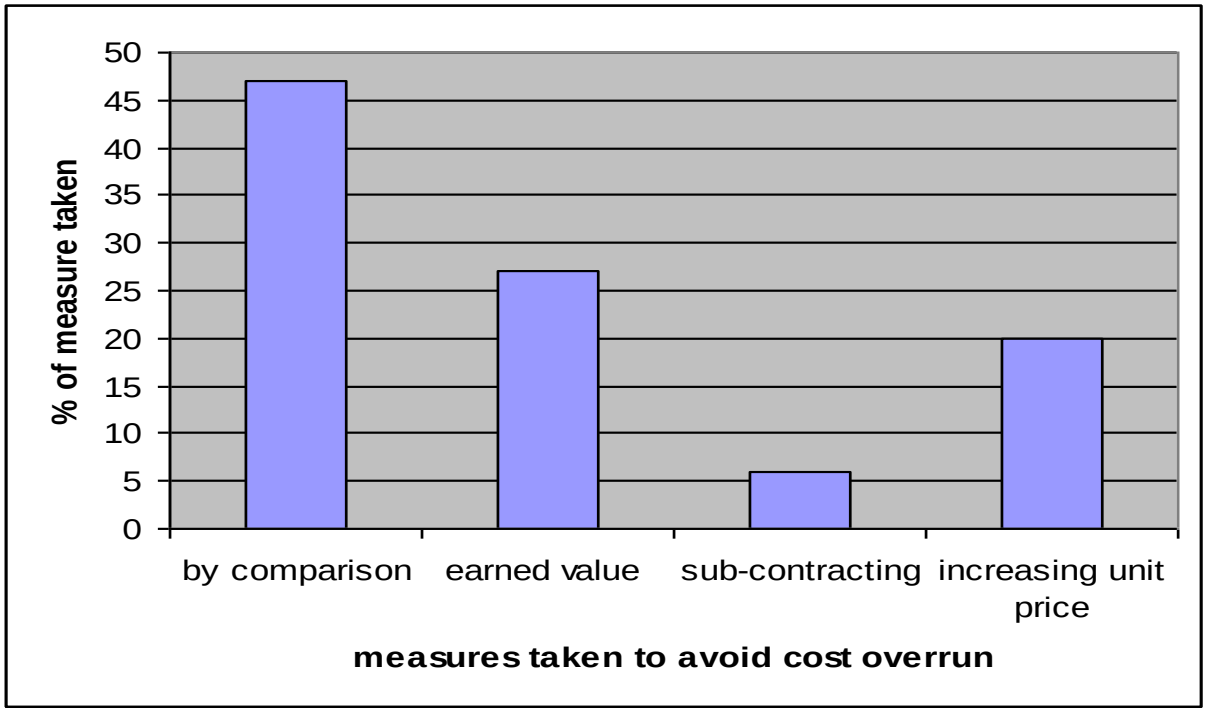


Fig.7. Measures taken to avoid cost and time overrun in housing projects.

Construction cost and time risks: - As explained in the literature review construction cost risks can be due to technical risks, design faults, construction faults, logistical risks, and financial risks. As the respondents said, the major factors that cause cost and time risks in their project are unforeseeable site conditions (like black cotton soil, hard core) and, insufficient planning documents, changes in planning, (calculation) and unclear specifications and others as internal mistakes in bid preparation & timeframe.

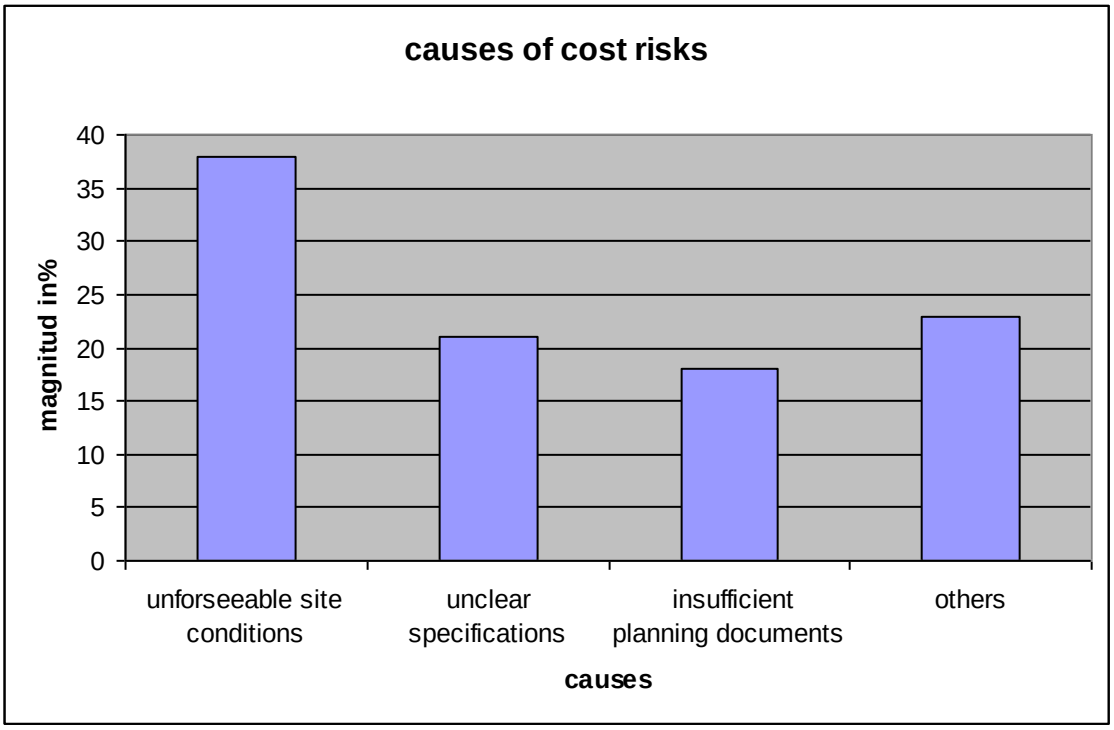


Fig.8. Causes of construction cost risks in housing projects.

Some items are not included or omitted with negligence or not well specified and also the time frame is not well studied when compared to the volume of the work originally at the planning phase of the project. As the respondents from the client side said, the measures taken are preparing the necessary documents, soil tests are conducted to the sites, additional timeframe is set to complete the project and all necessary specifications are prepared according to the design.

4.3 Cost and time Controlling Tools and Techniques

Earned value technique: - using earned value; any project can accurately monitor and measure the performance of projects against a cost and time base line (a firm base line). Measurements will take place at regular intervals, as of a given time, the project will determining its planed value, earned value and the actual costs incurred. These three dimensions provide a good data reflecting the true health of the projects. Therefore, the project management teams can at all times monitor both the cost and schedule performance status of their projects for their complete work using the three dimensions of earned value. Major tools and techniques for

cost and time controlling are cost change control system, performance measurement analysis, forecasting, project performance reviews and project management soft ware. These tools and techniques are very important to provide an early warning of performance problems while there is time for corrective action. In addition, improves the definition of project scope, prevents scope creep, communicates objective progress to stakeholders, and keeps the project team focused on achieving progress.

According to our literature review, most of the construction companies use earned value technique to measure cost and time performance review, to forecast and other knowingly or unknowingly. In our questionnaire, we divided the earned value technique when we ask the respondents internationally known or company internally created/modified. Most of the respondent's response was internally created and their response towards review cost and time performance, forecasting the cost and the like are set clearly below.

Software: -from the respondents that we have addressed no contractor use project management software. This is mainly due to lack of professional and no access to the soft ware.

Forecast: - according to our respondent, they forecast their cost position up to completion of their project by comparing the current cost position with the previous cost records. They do not forecast their cost and time performance to the future. This is due to either they ignore or do not know the significance of it.

Performance review: - As we know, in the execution of one project, there should be a structured company performance review which is important for the future improvement of the company's performance when there is cost and time variance . However, contractors in cost efficient housing projects, they revise only from the total profit point of view. Most of them use inspection types of cost and time controlling technique to control cost and time. As we compare it with our literature review, it agrees with unknowing use of earned value technique with traditional way. Not structural ways of cost and time controlling system are applied. This is mainly comes from:

- Lack of professional in the field of management
- They don't have access of software for this purpose

CHAPTE -5

CONCLUSIONS AND RECOMMENDATION

5.1 Conclusion

The following conclusions are drawn from the study:

- In housing projects, due to current conditions and boom of construction while the production of construction material/supply/ remains constant, labor rate variation, late delivery of materials, material price variation and consequently shortage of materials in the market are the main causes of cost and time variation.
- Due to cost and time variation by the above-mentioned causes and mismanagement of resources, there is cost and time overrun problem in housing projects.
- Untimely delivery of construction materials is one of the major causes for the increment of overhead costs (administrative and supervision costs). Because the manpower including project administrators, supervisors and other staffs are idle during delay of construction materials delivery.
- Design changes and other requirement changes (like type of soil on which the building to rest …) which result in increased cost and time for the completion of housing projects.
- Unforeseeable site conditions like black cotton soil, hard bedrock etc. insufficient documents, errors in bid preparation / calculation and unclear specifications are the major factors that result in cost and time risks.
- Most of the contractors working in housing projects use traditional way of cost and time controlling which is not updated from time to time and also these techniques vary greatly from company to company and from person to person. Almost no or little number of contractors use modernized earned value technique to know the performance of their company and also to forecast the cost and time performance and then to control their budget.

5.2 Recommendations

My recommendations are based on cost and time controlling problems stated in the literature and also based on the respondents' answers given to our questions what in reality is taking place or being practiced.

- The time frame, as from the original planning phase has to be improved (it has to include the time by which the delivery of construction materials is delayed)
- In addition to unforeseeable conditions (site conditions and untimely delivery of materials, unit price variations), referring the respondents, there is a loss and financial risk due to traditional way of cost and time controlling. Therefore, the way of cost and time controlling has to be changed and for each company, there should be a similar way but a modified tool or technique.
- Earned value management technique is the best way to know our current cost and time position, to forecast the future cost and time position and to take corrective action as soon as the problem occurred. Therefore, not only housing projects but also all construction companies have to use it by modifying the system for their own project. The main issue that goes with this is using key professional in this field or giving short-term training.
- Not only project managers but also other professionals responsible for cost and time management have to participate from the inception phase to completion for better accomplishment.
- There must be a habit of structured cost and time reports at intervals. The cost and time reporting system in housing projects is mostly on monthly bases for payment purpose. Therefore, it has to be improved and has to be on daily, weekly and monthly bases at the early, mid and end phases of the project respectively.
- As the construction sector is growing spontaneously, the government as well as the private sector should expand production or plants for construction materials to avoid shortage of materials in the market and consequently delay of projects.
- In order to avoid the problem of labor productivity, there should be a training program to gang leaders in order to improve labor productivity and crew productivity and from the contractor side they should implement appropriate human

resource management to increase the productivity. For this objective, the TVET programs are good beginnings and gang leaders and others involved in connection with daily laborers should bet trained. Generally, there should be good human resource management system for labor and crew productivity to be improved.

- Providing the personnel performing estimating duties with the right training and information as early in the estimating process as possible by stakeholders;
- Stakeholders need to build proper database of past projects to enhance knowledge transfer. Because, healthy and sound company cost and time database not only helps to have competent project cost estimates but it is also the sole basis to evaluate the performance of project execution during construction.
- All parties should develop a more definitive policy and approach to calculation of price escalation and time extension i.e. establish a consistent guidelines and approach to the monitoring, fore-casting and calculation of escalation based on the key project components;

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7. APPENDICES

Questionnaire

1. Does the organization, during the design phase of a project, impose a strict Methodology to control the cost and time of construction? Yes ____ No ____.

If yes, would you describe? If there is a written Protocol would you provide a copy?

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2. In your opinion, what are the four most important factors/issues in project enhancing Cost and time Overrun? Would you explain the contribution in percentage among the all?
_____
_____
_____

3. In your experience, what role does Earned Value Management (EVM ,value engineering and/or value management play in total project cost and time Control and also in design?
_____
_____

4. Are contractors ever consulted about cost and time Control before a project estimate and schedule is prepared? (for client and Consulatant)
Yes_____ No_____.

5. Are factors such as market conditions, anticipated time before execution, or geographic area of the project considered when preparing conceptual estimates?
Yes_____ _No_____.

6 . Do you attempt to make a detailed estimate of project Time and costs? (Detailed – means calculating production based on specific crews, equipment, and methods.)
Yes_____No_____.

7. How are baseline for cost and Time in a given project will be estimated in a given Project?_____
_____

8. Do you have any Delivery schedule and agreement for materials Supply to be delivered for contractors?
Yes _____ No ____.

9. What are the considerations in design phase your organization will account with respect to Cost and time management?

_____

_____

10. How is the supply of material from the client? (for Contractors only)
_____.

11. What steps are taken when estimates are not close to bid prices? At what percent difference are these steps taken? (for clients and consultant only)
_____
_____
_____.

12 .Do you have a reporting mechanism in daily, weekly and monthly basis to control cost and time overrun ? Yes_____No_____. If so, who is responsible for the stated activity? (for contractors
only)_____
_____

13. Do you have a session for training on the concept of controlling time and Cost in a given project? Yes _____No _____. If so, specify the type of training or software that you are applying?_____
_____.

Do you think that this will have a significant change on the Project progress? Your comment on this issue_____
_____

14. Please list four of the most frequent caused errors, mistakes, omissions in project design estimating interms of time and cost_____
_____
_____
_____
_____
15. What are four main problems or constraints encountered in project design estimates?
_____
_____
_____

16. Any other comments you wish to provide _____
_____
_____
_____